

Measuring Performance of e-Procurement Implementation in the Australian Public Sector: Results of a Preliminary Investigation

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Abstract:

Academic research on the many facets of the e-Procurement implementation in the public sector is still in its early stages. Many issues still need to be investigated. Most importantly, an integrated tool for the overall performance measurement of e-Procurement implementation is yet to be developed. This paper presents the results of a study whose objective was to develop components that constructs the instrument to measure the success of an e-Procurement implementation in the public sector in Australia. The overall goal of this preliminary investigation is threefold. Firstly, this paper provides definitions of e-Procurement, procurement process and e-Procurement tools. Secondly, various drivers of e-Procurement implementation and the status of major e-Procurement initiatives within the Australian public sector are reviewed. Thirdly, some key e-Procurement benefits and performance indicators as discussed by various authors and researchers have are presented.

1. INTRODUCTION

Electronic Procurement (e-Procurement) is one of the most discussed topics in the electronic commerce (e-Commerce) arena and the implementation of e-Procurement has seen dramatic growth in the recent years. Australia has been ranked fourth of 23 countries by Accenture's *e-Government Leadership* report; third of 196 countries by the World Market Research Center and Brown University's *Global e-Government* survey, and second in the world by the United Nations' *Benchmarking e-Government* report in terms of e-Government development (NOIE, 2002a). These reports suggest that Australia is actively pursuing e-Government. As part of its e-Government initiatives, many public sector agencies in Australia have placed a major focus on e-Procurement, and a number of initiatives are undertaking.

Will the Australian Government succeed in advancing an e-Government agenda through e-Procurement initiatives? Are the current e-Procurement implementations delivering the value for money in terms of efficiency and effectiveness? What indicators and measures are important in mapping the performance of these initiatives? The answers to these questions are very important if we are to evaluate the success of e-Procurement implementation in the Australian public sector. Clauthard and Castleman (2001) note that there has been almost no critical evaluation of the organisational issues and implications of implementing these programs.

The overall goal of this preliminary investigation is threefold. Firstly, this paper provides various definitions of e-Procurement, procurement processes and e-Procurement tools. Secondly, a preliminary look at the current status of e-Procurement initiatives within the Australian public sector agencies is provided and various drivers of e-Procurement initiatives are reviewed. Thirdly, some key e-Procurement benefits and performance indicators as identified by various authors have been presented.

2. METHODOLOGICAL APPROACH

A preliminary literature survey was conducted along with a key word search of the World Wide Web. The key words/phrases were "electronic procurement", "electronic procurement performance measurement", "electronic performance metrics" and "electronic procurement implementation Australia". The literature used in this study came from three categories of materials: journal articles, popular business press and government reports. The preliminary investigation included the available e-Procurement related international journal articles, best practices reviews, conference papers, government reports (Australia, US, UK and Ireland) and white papers.

The search engine used was Google.com and databases such as Proquest, Emerald Library and ACM Digital Library were used. It should be noted that as the topic of e-Procurement is quite new and relatively few journal articles and

books have, as yet, published, much of the material has been gathered from the various websites. A table of e-Procurement related benefits/factors suggested by various authors was constructed and only the benefit or factor/s supported by a minimum of three authors and/or researchers have been included in the table.

3. DEFINITIONS, PROCESS AND APPLICATIONS

3.1. Definitions

E-Procurement is not new – Electronic Data Interchange (EDI) has been used as a basis of electronic purchasing by private as well as public sectors for over a decade. The use of EDI has not been as successful as had been expected. This may be attributed to the high cost related to proprietary implementation, conflicting standards and difficulty in integrating with catalogues (McCrea, 1997).

What is new is the use of e-Commerce in procurement. The introduction of the Internet has truly changed the ways organisations conduct procurement in the nineties. These open systems provide several advantages over earlier inter-organizational communication tools such as EDI. Talero (2001) points out three principal technologies that are enabling the rapid development of e-Commerce worldwide: i) the Internet as a global connectivity platform ii) the World Wide Web as a global networking facility; and iii) the public key security infrastructure (PKI) as the electronic integrity and authentication mechanism.

However, despite its popularity, there is no common definition of e-Procurement. As stated by Murray (2001), “much confusion exists in terms of what is meant by e-Procurement”. The table below presents different definitions of the term (Table 1).

Table 1. Definitions of e-Procurement

Author/s	Definitions of e-Procurement
Davila et al. (2003)	... any technology designed to facilitate the acquisition of goods by a commercial or government organisation over the Internet
BuyIT (2002)	... the electronic management of all procurement activities...., the use of Web communications to ‘e-enable’ your purchasing process and strategy
Birks et al. (2001)	... the use of web-based technologies and communications in the purchasing cycle from requisition and approval through to receipt and settlement
NECCC (2002)	... is a marriage of strategic sourcing and an electronic procurement tool
CIPS (2001)	... the combined use of information and communication technology through electronic means to enhance external and internal purchasing and supply management process
DPWS (2001)	..the use of e-Commerce for procurement

3.2. Procurement Process

Public sector agencies depend on the procurement process for the proper functioning of their various elements. It is assumed that the more effective the procurement process, the more efficiently the agencies will function (NECCC, 2002). As can be seen from the above definitions, e-enabling the 'procurement process' has been cited as the most important characteristic of e-Procurement by the literature. However, there is no consistency of phases of the procurement process in the literature as shown in the table below (table 2).

Table 2. Phases of the procurement process as viewed by various authors

Author/s	Phases of the procurement process
Gebauer et al. (1999)	i) information, ii) negotiation and, iii) settlement
Archer and Yuan (2000)	i) information gathering, ii) supplier contact, iii) background review, iv) negotiation, v) fulfillment, vi) consumption, maintenance and disposal and, vii) renewal
DOF (2001)	i) strategic sourcing (specifying requirements, selecting the supplier and agreeing contracts), ii) the transaction process (ordering, receiving and payment) and, iii) recording and compliance (contract management, supplier management; performance management and information management)
Subramaniam and Shaw (2002)	i) search ii) order processing iii) monitoring and control iv) coordination

3.3. Types of E-Procurement Applications

Earlier studies indicate a need to distinguish between different types of procurement materials and process. Procurement usually covers two types of purchases – direct (raw materials and components) and indirect (goods and services/MRO products) (Neef, 2001). There are two types of procurement process – structured and unstructured (Ware et al., 1998). While e-Procurement can support both direct and indirect purchases as well as structured and unstructured procurement process, Subramaniam and Shaw (2002) propose that use of e-Procurement (web-based) for unstructured procurement results in greater value than using it for structured procurement.

The e-Procurement market offers various types of e-Procurement systems. This includes e-Procurement software, e-Tendering software, electronic catalogues, and vertical and horizontal marketplaces according to the requirements of the organisation (CIPFA, 2002). However, the terms such as 'forms', 'approaches',

‘modules’, ‘models’ and ‘components’ have been used in the literature to refer to individual applications of a full (end-to-end) e-Procurement system as shown in the table below (Table 3).

Table 3. Various applications of e-Procurement

Author/s	e-Procurement what?	e-Procurement Applications
Boer et al. (2001)	<i>forms</i>	i) E-sourcing, ii) E-MRO, iii) Web-based ERP, iv) E-tendering, v) E-reverse auctions, and vi) E-informing
DOF (2001)	<i>approaches</i>	i) Electronic Tendering ii) Electronic Catalogue-based Procurement (eOrdering), iii) Electronic Marketplaces (eMarkets)
BuyIT (2002)	<i>modules</i>	i) e-sourcing, ii) e-tendering, iii) e-invoicing, iv) online bidding, v) e-intelligence, and vi) e-collaboration
Davila et al. (2003)	<i>models</i>	i) e-Procurement systems (software), ii) B2B (business-to-business) Auctions, iii) B2B market exchanges, and iv) purchasing consortia
Talero (2001)	<i>System Components</i>	i) information and registration, ii) electronic tendering, and iii) electronic purchasing (e-shopping, e-auction)

3.4. Terminology Used in This Paper

Procurement terms defined by the *CIFPA e-Government Forum Report* (CIFPA, 2002) have been used in this paper. They are listed below:

- e-Procurement will refer to Internet-based procurement in general and not refer to any specific e-Procurement functionalities or systems.
- e-Purchasing will refer to Internet-based electronic systems which allow for requisition through to payment.
- e-Tendering will refer to Internet-based electronic systems that allow invitation and submission of tenders, and components of such systems.
- Procurement will refer to the end-to-end process of acquisition with emphasis on strategic relationship and the delivery of best value.

4. AUSTRALIAN GOVERNMENT'S STRATEGIES FOR E-PROCUREMENT

Australian governments have identified e-Procurement as a key strategic tool in increasing competitiveness of the national economy by reducing procurement costs. The federal and state governments of Australia have commissioned a number of high profile reports to explore the potential of e-Procurement within the Australian public sector. Some of the major reports which act as the drivers for e-Procurement initiatives are as follows:

- Framework for National Cooperation on Electronic Commerce in Government Procurement (APCC 1999): The updated Framework revised in 2002 supports businesses as they trade directly with governments and with each other, in a low cost and secure environment. Any e-Procurement implementations within government agencies should be consistent with this framework.
- Commonwealth Electronic Procurement Implementation Strategy (DCITA 2000):
The strategy sets out the Commonwealth Government's strategy for implementing e-Procurement in its agencies. It provides agencies with a framework to build on and enhance their capabilities to trade electronically, and is intended to encourage suppliers to the Commonwealth to consider their own guidelines for e-commerce.
- Risk Management in Electronic Procurement, Strategies for implementation (DPWS, 2000): This report outlines risk management issues introduced by the move to e-Procurement and considers strategies for dealing with these risks.
- Electronic Procurement Implementation Strategy (DPWS, 2001): The implementation strategy, which is consistent with APCC's *Government Framework for National Cooperation on Electronic Procurement* sets out the goals and targets for electronic procurement by the NSW Government, its agencies and service providers wishing to do business with government.
- Doing Business Online with Government (NOIE, 2002): This guide assists suppliers to trade electronically with Commonwealth Government agencies. The guide also highlights the benefits of trading electronically with Government and suggests how suppliers can get started doing business online.
- Performance Audit Report: e-government: Electronic Procurement of Hospital Supplies (AO, 2002): As part of an ongoing series of performance audits in the area of e-Government, the Audit Office of NSW examined e-Procurement in the NSW Health. Of key importance is the conclusion that "there is a need to establish more robust performance management control and systems over the supply chain to ensure greater accountability for and transparency of public expenditure".

5. E-PROCUREMENT INITIATIVES WITHIN THE AUSTRALIAN PUBLIC SECTOR

The e-Procurement initiatives in the Australian public sector date back to early 1996 when its first e-Procurement system, Transigo, was implemented with the help of Telstra, an Australian Telecommunications Company. Electronic Tender Box, Trading Document Service and Catalogues were the key features of Transigo (McCrea, 1997). The system failed because of very low take up rates by suppliers (Charles, 1999). Coulthard and Castleman (2001) argue that there has been little or no detailed analysis of the failure of the Transigo e-Procurement system.

Following the failure of Transigo, the Australian Government, in January 1999, announced its intention to move towards a new electronic commerce system and over the last couple of years, Australian public sector agencies have been actively engaged in e-Procurement initiatives. The review of e-Procurement Newsletters from April 2002 to June 2003 published by the National Office for the Information Economy (NOIE) (available at www.noie.gov.au/) and other government publications including the ones listed in section 4 above reveal that there has been a number of initiatives taking place in the area of e-Procurement. Some major developments are as follows:

- Electronic Commerce for Procurement (EC4P): The Victorian Government's Department of Natural Resources and Environment (DNRE) is a leader in implementing e-Procurement, reducing its average transaction costs from \$66 to \$16 per transaction through its e-Procurement initiative called Electronic Commerce for Procurement (EC4P). The Victorian Government announced in December 2001 that electronic purchasing and payment system (EC4P) will be implemented in Victorian government departments and the Victorian Police. Most departments have completed their final business cases and rollout has commenced.
- Agriculture, Fisheries and Forestry Australia (AFFA): In December 2001, a staged roll out of the system was commenced. The system has streamlined AFFA's accounting processes and supplier contract management. Other benefits achieved include an improved ability to negotiate price reductions on online contract items.
- The Government Electronic Marketplace (GEM): GEM is an online government buying service established by the Western Australia government for the purchase of low value commodities and public tendering for high value goods and services. It deals with all aspects of procurement in an 'end-to-end- solution – e-Catalogues, quotations, approvals, ordering, payment and receipting.
- Australian Antarctic Division (AAD): In 2001, AAD and Tasmania Business Online (TBO) conducted a joint e-Procurement awareness campaign for their suppliers, generating interest, although some businesses

- have chosen to adopt a 'wait-and-see' approach.
- B2Buy eMarketplace: Centrelink is conducting tests with Westpac's (a major Australian Bank) B2Buy e-Marketplace with a number of its credit card users across Australia. The Department of Prime Minister and Cabinet is another adopter of the marketplace.
- Online Tendering: Maritime Constructions uses the South Australia government's online tendering facility to simplify the process of retrieving and lodging tenders.
- e-Procurement Demonstrations: In order to enable Federal Government Agencies to test online procurement with a focus on transactions between government and SME's, the e-Procurement Demonstration Projects were developed by NOIE.
- Government Sector e-Catalogue Interoperability Project: The Government Sector e-Catalogue Interoperability Project was initiated in response to the issue of the absence of strong standards for catalogue content. The project is a "proof of concept" initiative that will display methods to reducing and/or eliminating multiple catalogue publications by public sector suppliers.
- Buyers Enablement Project: Buyer Enablement Project, expected to be completed by the end of 2003, will provide government and private sector organisations with a "how to" guide for e-procurement projects.
- Electronic Tender System (CETS): CETS was piloted successfully in 2001 and its redevelopment is under way. NOIE is currently assessing options for redevelopment, to provide enhanced capacity and functionality, including "push" notification to suppliers of Commonwealth business opportunities.
- e-Procurement at Department of Defense: With the help of IBM, Defense is building an e-Procurement capability into its existing purchasing and financial management information systems.
- e-Procurement projects in NSW: Current initiatives in NSW that are completed or being implemented include NSW Government Electronic Marketplace, NSW Health e-Tendering System, e-Tendering system in Sydney Water, QICS Web, buy.gov, Q Stores Online, Asset.gov etc.

Considering the actual cases of implementation and adoption from 1996 to 2003 as stated above, it appears that although e-Procurement is still in its infancy, the adoption of e-Procurement is slowly, but steadily increasing. Overall, this review shows that despite the widespread interest in e-procurement its adoption is still limited, however, it is perceived to have a significant impact on various performance measures.

6. IMPLICATIONS OF E-PROCUREMENT PERFORMANCE MEASUREMENT

Why focus on measuring e-Procurement performance? A study from the Hurwitz Group, published in December 2000 revealed that 50% of Fortune 500 companies

had little or no idea how well their e-Procurement systems were performing (Bawden, 2001). The situation should be no less serious in the public sector. Even as the public sector agencies are implementing e-Procurement systems in the hope of improved value for money, there is a need to fully define the indicators and develop performance measures. Once we do this, it will provide a basis to establish the baseline data, measure and compare the performance of the e-Procurement implementation.

A number of early e-Procurement adopters have recently left the market because of a failure to achieve the benefits they expected. The reason for failure may lie in the “failure of these companies to observe the basic principles of measuring benefits and implementation success”, argues Dodds (2001).

Though some public sector agencies in Australia and overseas have attempted to measure e-Procurement performance by using the traditional measures, most measures have been inadequate to describe e-Procurement. Performance measurement established for a traditional procurement environment is not applicable to the procurement in the electronic environment. It is necessary to go beyond traditional procurement metrics and introduce a dynamic measurement system that focuses on e-Procurement performance (Vaidya et al., 2002).

7. E-PROCUREMENT: MAJOR BENEFITS AND SUCCESS FACTORS

If e-Procurement implementation performance measurement is important, the challenge is to design a measurement system that will help government assess its progress and set a course. As a first step, it is useful to review what the major benefits are and what indicators and measures exist in the current e-Procurement literature.

E-Procurement affords the public sector the opportunity to realise efficiency gains through a reduction in the transaction costs associated with procurement (DOF, 2001). Eakin (2003) has identified the principle metrics that can demonstrate a return on investment (ROI) in e-Procurement as transactional benefits, compliance benefits, management information benefits, price benefits and payment benefits. Other intangible benefits identified by him include cultural change and high visibility of supplier performance.

All e-procurement applications aim to improve the efficiency of purchasing personnel, automating the approval cycle, enabling negotiation of better contract pricing, leveraging existing contracts more effectively and reducing off-contract purchases (Croom, 2001). To maximise value for money, contracts should be in place, and complied with, for as large a proportion as possible of all expenditure (DOF, 2001). Baura et al. (2001) suggest that e-Procurement managers must focus on such drivers as supplier-related processes, supplier orientation of IT applications, systems integration, and supplier readiness that have direct impact on the firm's ability to conduct online business with its suppliers.

There is prospect to diminish maverick purchasing (CIPFA, 2002) and reduced inventory levels and costs through the adoption of the e-Procurement practices

(DOF, 2001). Among other benefits, Feigi (2001) advocates the transparency, control orientation, and cost saving benefits of e-Procurement.

In addition, when considering automating or reengineering a purchasing process, Seveg et al. (1998) emphasize the importance of flexibility – a measure to handle exceptional demand. PeopleSoft (2001) claims that organisations can achieve enormous return on investment by focusing on interoperability of the e-Procurement system - a factor to ensure interconnections between systems inside and outside the organisation. Systems integration across different channels of operation enables an organisation to transmit, combine and process data from customers and suppliers (Barua et al., 2001). An e-Procurement system must have the interfaces needed to link to internal organisational applications as well as to consider external to customers' and suppliers' systems (GartnerGroup, 2000).

A review of the studies above and available published empirical research on e-Procurement performance shows that performance measures can be grouped primarily along the following dimensions as shown in Table 4.

8. E-PROCUREMENT: KEY PERFORMANCE INDICATORS

Dodds (2001) has divided the key performance indicators (KPIs) into two categories: implementation KPIs and benefits KPIs. Implementation KPIs provide information about the penetration of e-Procurement into the organisation while business benefits KPIs compare the benefits actually realised with the identified benefits. Similarly, OSD (2001), BuyIT (2002) and Talero (2001) have identified some KPI's in terms of percentage that can be used to measure e-Procurement performance as shown in the table below (Table 5).

Table 4. Overview of literature survey on key e-Procurement benefits and success factors

Benefits/Factors	Authors
Value for Money	Birks et al. (2001), Segev et al. (1998), DOF (2001), Talero (2001)
Customer/Supplier Satisfaction	Segev et al. (1998), OSD (2001), AO (2002), Subramaniam and Shaw (2002)
System Interoperability	GartnerGroup (2000), PeopleSoft (2001), AO (2002)
System Integration	Barua et. al. (2001), Croom (2001), GartnerGroup (2000) DOF (2001), OSD (2001) Talero (2001), Subramaniam and Shaw (2002)
Change Management	Eakin (2003), Barua et al (2001), DOF (2001) NECCC (2002),
Quality of Business Process	Birks et al. (2001), Segev et al. (1998), DOF (2001) Subramaniam and Shaw (2002)
Business Process Transparency	Talero (2001), DOF (2001), Feigi (2001), Talero (2001)
Competition	DOF (2001), OSD (2001), Talero (2001)
Process Efficiency	DOF (2001), OSD (2001) NECCC (2002), Talero (2001), Hartman (2002)
Effectiveness	Talero (2001), CIPFA (2002), Hartman (2002)
Management Information	Eakin (2003), Birks et al. (2001), Talero (2001), Croom (2001), GartnerGroup (2000), NECCC (2002), AO (2001) Talero (2001), CIPFA (2002)
System Responsiveness	Subramaniam and Shaw (2002), OSD (2001),
Buyer Compliance	Eakin (2003), Birks et. al. (2001), Segev et al. (1998), CIPFA (2002)
Supplier performance	Eakin (2003), Dodds (2001), CIPFA (2002)
Total procurement cost	Segev et al. (1998), DOF (2001), Subramaniam and Shaw (2002), CIPFA (2002)
Supplier relationships	Segev et al. (1998), DOF (2001), AO (2001), Subramaniam and Shaw (2002)
User behaviour	Segev et al. (1998), DOF (2001), Hartman (2002)

Table 5. Overview of literature survey on key e-Procurement performance indicators

Author/s	Suggested percent KPIs
Dodds (2001)	% of items accessible on website catalogs, % of relevant items ordered, % saved on traditional contracts through e-Auctioning tools
OSD (2001)	% of transactions processed online, variance in planned vs. actual ROI, % customer satisfied, % of new suppliers, % of average turnaround time for responses, increase/decrease of average turnaround time, increase/decrease in cost of transactions, % of software deficiency rates, % of above/below industry standard 99% uptime
BuyIT (2002)	% of reduced maverick spend, reduced requisition to PO time, average time in days to approve purchase order, reduced invoice to payment time, % of total dollar saved attributed to volume guarantee, % of the negotiated saving attributed to the guarantee of prompt payment, decrease in debtor days per supplier
Talero (2001)	% of the number or value of total procurement transaction, % of procurement transactions timely and accurately disclosed for examination and oversight

9. GAPS IN THE LITERATURE AND DIRECTIONS FOR THE FUTURE RESEARCH

e-Procurement is a new subject and in-depth expertise and knowledge is yet to be acquired (Heywood, 2002). While the interest in public sector e-Procurement is growing, there is very little in the way of specific research to guide the public sector agencies on what to measure and how to measure. While much has been written on e-Procurement in general, however, no literature specifically on e-Procurement Performance Measurement could be found. In addition, most of the published literature both practitioner and academic is biased towards the private sector and focused on cost savings. And the performance measurement/evaluation phase of the e-Procurement implementation has received little attention.

Several authors have argued that performance measurement is one of the most critical stages of an e-Procurement initiative (Dodds, 2001; Hartman, 2002; DOF, 2001; NECCC, 2002; Neef, 2001). Yet, there is still a lack of consistent and well-agreed criteria as to what constitutes e-Procurement performance measurement. Though some success factors and performance measures have been identified, these vary from author to author and are not consistently defined and measures have not been operationalised. There are inconsistencies in defining the term 'e-Procurement' and 'procurement process'.

Academic research on the e-Procurement implementation in the public sec-

tor is in its infancy. Many questions need to be addressed, such as:

- 1) What are the indicators, and measures leading to the success of an e-Procurement implementation in the public sector?
- 2) How are these success factors related in a casual context?
- 3) What are the gaps between expected and actual practices?
- 4) Where are the weaknesses? What conclusions can be drawn to improve the performance of an e-Procurement implementation within and across public sector agencies?

Answering the above questions will help measure the performance of an e-Procurement implementation and provide valuable implications to public sector e-Procurement managers and academics. However, this can be a difficult task as answers to these questions require more than just the issues discussed in this paper. And most importantly, cooperation and support of all stakeholders including seniors managers involved in the implementation can be as imperative as the availability of data. So the question of whether the Australian public sector agencies that have implemented or are in the process of implementing e-Procurement systems are actually willing to participate in the performance measurement will eventually determine the success of future research projects.

10. CONCLUSIONS AND DISCUSSIONS

This study reviewed the current status of e-Procurement in Australian public sector. Key success factors and benefits of e-Procurement were concluded and performance indicators that can be used to assess the success of an e-Procurement implementation listed.

This paper clarified the definition of e-Procurement, outlined the many shapes e-Procurement can take as detailed in the literature. A primary challenge remains, however, to use measurement as a tool in managing e-Procurement initiatives. The indicators and measures discussed in the paper should enable the e-Procurement professionals and practitioners to better prepare and plan what to measure about their e-Procurement implementation.

While this preliminary investigation has identified several government reports as the drivers of e-Procurement implementation in the Australian public sector, at present, it seems that there is no driver or motivation in the Australian public sector for the realisation of the benefits of e-Procurement implementations. Most importantly, a satisfactory tool for the overall performance measurement of e-Procurement implementation is yet to be developed.

Public sector agencies need guidance in their efforts to e-Procurement implementation. This preliminary research will enrich the understanding and knowledge in the field of e-Procurement implementation. The success factors and indicators presented should provide insights to e-Procurement management in the public sector.

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